

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization International Bureau



(43) International Publication Date
3 June 2004 (03.06.2004)

PCT

(10) International Publication Number
WO 2004/046994 A1

(51) International Patent Classification⁷: **G06F 19/00, G06T 7/60**

(21) International Application Number:
PCT/GB2003/004910

(22) International Filing Date:
13 November 2003 (13.11.2003)

(25) Filing Language: **English**

(26) Publication Language: **English**

(30) Priority Data:
0227160.9 21 November 2002 (21.11.2002) GB

(71) Applicant (*for all designated States except US*): **QINETIQ LIMITED [GB/GB]; 85 Buckingham Gate, London SW1E 6PD (GB).**

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **PETROU, Maria**

[GB/GB]; School of Electronics Computing and Mathematics, University of Surrey, Guildford GU2 7XH (GB).

KESIDIS, Anastasios [GR/GR]; Sevastopoulou 25, 11524 Athens (GR). VARGA, Margaret, Jal [GB/GB]; Qinetiq Limited Malvern Technology Centre, St Andrews Road, Malvern, Worcestershire WR14 3PS (GB).

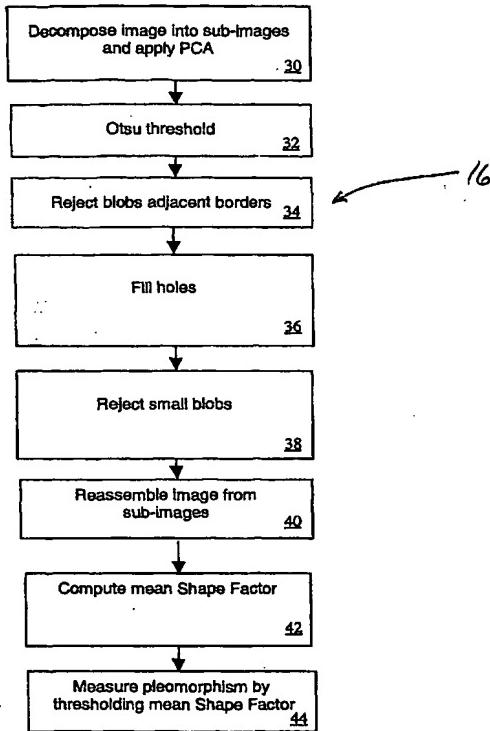
DUCKSBURY, Paul, Gerard [GB/GB]; Qinetiq Limited Malvern Technology Centre, St Andrews Road, Malvern, Worcestershire WR14 3PS (GB).

(74) Agent: **WILLIAMS, A.W.S.; IP Qinetiq Formalities, Cody Technology Park, A4 Building, Room G016, Ively Road, Farnborough, Hampshire GU14 0LX (GB).**

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU,

[Continued on next page]

(54) Title: **HISTOLOGICAL ASSESSMENT OF NUCLEAR PLEOMORPHISM**



(57) **Abstract:** A method of histological assessment of nuclear pleomorphism to identify potential cell nuclei divides image data into overlapping sub-images. It uses principal component analysis to derive monochromatic image data, followed by Otsu thresholding to produce a binary image. It removes image regions at sub-image boundaries, unsuitably small image regions and holes in relatively large image regions. It then reassembles the resulting sub-images into a single image. Perimeters (P) and areas (A) of image regions which are potential cell nuclei are determined and used in calculating nuclear shape factors P^2/A . Nuclear pleomorphism is assessed as relatively low, moderate or high according to whether predetermined shape factor thresholds indicate a mean cell nucleus shape factor for an image is relatively low, moderate or high.



SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA,
UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

- (84) Designated States (*regional*): ARIPO patent (BW, GH,
GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE,
SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA,
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— *of inventorship (Rule 4.17(iv)) for US only*

Published:

— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.